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ABSTRACT

Designed to help university and college faculty, academic administrators, and testing personnel select appropriate tests for college admission, this booklet provides a comparative description of the three chemistry examinations offered by the College Board. In separate sections, the following topics are covered: faculty involvement in test development; content of the Admissions Testing Program (ATP) Achievement Test in Chemistry, the Advanced Placement (AP) examination, and the College Level Examination Program (CLEP) test; cognitive abilities measured in the tests; differences among the examinations; and advanced placement student and college student performance on the tests. A glossary and several tables of test data are included. (LP)

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THE CHEMISTRY EXAMINATIONS OF THE COLLEGE BOARD. 1980-1982

1980

College Entrance Examination Board
New York, New York

and

Educational Testing Service
Princeton, New Jersey

SE 041 784

The Chemistry Examinations of the College Board 1980-82

The College Board offers three examinations in chemistry:

- Admissions Testing Program (ATP) Achievement Test in Chemistry
- Advanced Placement (AP) Program Examination in Chemistry
- College-Level Examination Program (CLEP) Subject Examination in General Chemistry

All three of these examinations help postsecondary educational institutions respond to the varied backgrounds of entering students. The tests provide a means of assessing already acquired skills and knowledge in chemistry so that students can be placed in appropriate courses or can receive recognition for learning equivalent to that gained through college courses. Certain subject matter examinations are available for local administration at colleges through Multiple Assessment Programs and Services (MAPS) of the College Board.

This folder provides comparative descriptions of the examinations to help faculty members, academic administrators, and testing personnel choose the tests that will best meet their requirements. It should also enable high school teachers of chemistry to guide students to a particular examination on the basis of the students' preparation and needs, as well as the policies of their prospective colleges. Each college or university determines not only which instruments to use, but also the level of performance that an individual must demonstrate to obtain credit and/or placement in a particular course. Students should determine their prospective college's policies before taking an examination. The pamphlet *Guidelines on the Uses of College Board Test Scores and Related Data* provides specific advice.* Also the College Board, through its regional offices, helps institutions develop policies and practices suited to their needs.

*The Order Form gives further information about *Guidelines* and other publications relating to the chemistry examinations of the College Board.

Faculty Involvement

Faculty involvement provides a critical link to the changing practices, curriculums, and standards of American chemistry education. College and secondary school faculty members actively teaching chemistry make up the membership of both the Advisory and Development Committees. The Advisory Committee on Chemistry establishes policy guidelines concerning the content and format of these examinations. The Development Committees are responsible for more detailed decisions about the content and format of each examination, as well as its actual development. Development Committees, often assisted by other consultants, write most of the questions that appear in experimental and final forms of the examinations. In addition to reviewing each other's questions by correspondence, committee members meet once or twice a year with test development specialists from Educational Testing Service (ETS) to make final revisions and final selection of questions. An integral part of the committee meeting is the discussion of current content and statistical specifications. Also discussed are possible future changes in light of previous candidate performance, evolving curriculums, and suggestions received from teachers. A selected group of college chemistry teachers and secondary school AP teachers grade the free-response (essay) questions of the AP Examinations in a central location. The free-response sections of the AP Examinations written by individual students are available to colleges and schools on request to ETS.

The Examinations

ATP Achievement Test in Chemistry

Assumed Preparation: A one-year introductory course in chemistry at a level suitable for college preparatory work is required. The test covers a core of topics found in most secondary school chemistry courses. It measures student achievement in high school chemistry courses regardless of differences in approach. Norms are provided annually for students taking the test.

This folder was prepared and produced for the College Board by Educational Testing Service.

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THE CHEMISTRY EXAMINATIONS OF THE COLLEGE BOARD

	Coverage	Format	Administration (When and Where Given)
ATP Achievement Test in Chemistry	Secondary school introductory course in chemistry	60 minutes: 90 multiple-choice questions	Five times a year at ATP Test Centers
AP Examination in Chemistry	One-year introductory college course in chemistry	90 minutes: 80 multiple-choice questions 90 minutes: free-response section consisting of chemical problems, equations, and short essays	Annually in May in AP Participating Schools
CLEP Subject Examination in General Chemistry	One-year introductory college course in chemistry	90 minutes: 80 multiple-choice questions 90 minutes: optional essay section	Monthly at CLEP Test Centers

Possible Uses: The test is used as a selection instrument for admission to college and in assigning individual students to courses that best fit their background and experience. This placement use is appropriate for the colleges that offer several first-year chemistry courses at different levels. The Achievement Test score is reported on a scale of 200 to 800.

AP Examination in Chemistry

Assumed Preparation: The AP Development Committee in Chemistry assumes the equivalent of a first-year course in college chemistry. The guide for such work is the published course description developed and updated regularly by the Development Committee. A formal course, usually in the form of a special AP Chemistry class in the secondary school, is assumed to be the principal or usual means of preparing students, although some students are successful through independent study. Candidates should be skilled in laboratory techniques and experienced in performing experiments and analyzing data.

Possible Uses: The examination is designed for placement and for credit use at the level of one year of college chemistry. Because only one grade is reported, the test is inappropriate as a measure of achievement on a semester basis. Advanced Placement grades, based on both the multiple-choice and essay sections, are reported on a five-point scale: 5—extremely well qualified, 4—well qualified, 3—qualified, 2—possibly qualified, 1—no recommendation. Participating colleges normally honor grades of 3 or higher.

CLEP Subject Examination in General Chemistry

Assumed Preparation: The examination is based on the core elements of most introductory courses in college chemistry, and a relatively wide range of educational background would serve as preparation. Mastery of the content of a college or university introductory course in chemistry would be obvious preparation. Such mastery may be obtained through a formal course or through informal educational experiences, such as wide and careful reading in an area, job experience in a laboratory, and independent projects. The examination is normed on undergraduates completing a first-year college course in chemistry.

Possible Uses: The examination is designed for placement decisions and for awarding credit. The examination does not provide subscores on any group of topics and, therefore, does not lend itself readily to partial credit on a semester basis. The CLEP examination score is reported on a scale of 20 to 80.

In addition to the three examinations described above, the College Board offers the CLEP General Examination in Natural Sciences, which provides subscores in biological and physical science. The physical science subscore covers topics in physics, astronomy, and earth science in addition to chemistry. Only about one-third of the physical science questions deal with chemistry. The CLEP examination is appropriate for satisfying a distribution or general education requirement in the natural sciences. A more detailed description of the examination appears in the booklet *CLEP General and Subject Examinations.*

Cognitive Abilities

The cognitive abilities involved in answering the examination questions follow in an ascending scale of levels:

1. *Knowledge* of basic factual information
2. *Comprehension* involving translation of information presented in a question into another form. The question may include a law or principle in words; the answer may describe the same information by a graph, an equation, a set of data, or an example.
3. *Application* of fundamental chemical principles to familiar or unfamiliar situations and the ability to solve quantitative chemical problems
4. *Higher Level Abilities* including analysis of a particular phenomenon or problem, synthesis of sequences of steps in chemical experiments and interpretation of the results obtained by observations, evaluation of chemical situations or procedure, and the assessment of experimental uncertainties

Distribution of the cognitive levels of questions in each of the chemistry examinations varies somewhat from year to year, but estimates of distribution of each skill for the multiple-choice sections are given in the table below. Free-response questions generally involve application and higher level abilities, although they draw on other cognitive levels as well.

COGNITIVE LEVELS OF MULTIPLE-CHOICE SECTIONS

	Knowledge	Comprehension	Application	Higher Level Abilities
ATP Achievement Test in Chemistry	30%	5%	60%	5%
AP Examination in Chemistry	20%	5%	65%	10%
CLEP Subject Examination in General Chemistry	20%	5%	65%	10%

Differences among the Examinations

The differences among the three examinations lie primarily in the level of sophistication of the questions and the nature of the tasks required rather than in the content. (See the Content Specifications table below.) These differences are partially reflected in the number of questions to be answered in a given length of time for the Achievement Test and for the multiple-choice sections of the AP and the CLEP examinations. The

CONTENT SPECIFICATIONS
(by approximate percent of test)

	ATP Achievement Test in Chemistry	AP Examination in Chemistry (multiple-choice section)	CLEP Subject Examination in General Chemistry (multiple-choice section)
Structure of Matter	24	20	20
States of Matter	9	10	10
Solutions and Concentrations	6	9	9
Reactions of Matter			
a) water, acids, bases	9	12	12
b) oxidation—reduction and electrochemistry	9		
c) equilibrium, kinetics, and thermodynamics	10	16	16
Stoichiometry	10*	10*	10*
Descriptive Chemistry	16	14	14
periodic classifications, metals, nonmetals, introductory organic chemistry			
Laboratory	7	9	9
	100%	100%	100%

*Includes balancing equations

Achievement Test in Chemistry covers the subject matter in a more elementary way than either the AP or the CLEP examination.

On the recommendation of the Advisory Committee, the CLEP Subject Examination in General Chemistry now has content distribution similar to that of the AP Examination in Chemistry. Since January 1979, the multiple-choice portions of the AP and the CLEP chemistry examinations are comparable.

The AP Examination has a required free-response section that takes half of the time for the examination. Recent forms of the examination include questions calling for three different kinds of responses: solving quantitative problems requiring the application of principles from various topics including equilibrium, kinetics, thermodynamics, stoichiometry, electrochemistry, solution chemistry; predicting the formulas of the products of chemical reactions; writing short essays that interpret chemical phenomena and illustrate chemical reasoning. The essay section of the CLEP Subject Examination in General Chemistry is optional and graded by the receiving college. Its coverage is similar to that of the free-response section of the AP Examination in Chemistry.

Comparison of AP Candidates with Students Finishing a First-Year Chemistry Course in College

During the spring of 1978, the 90-minute multiple-choice section of the 1978 AP Examination in Chemistry was administered to over 3,000 students enrolled in general chemistry courses at 32 representative colleges. The average AP Chemistry candidate scored significantly higher than the average college student tested. Based on a raw score scale of 0-80, 62.9 percent of the AP candidates scored at or above the raw score of 40, whereas 37.2 percent of the college students earned scores in that range.

The distribution of final course grades for the college students in the sample was as follows: 19.0 percent received a final course grade of A; 30.8 percent received B; 37.0 percent received C; and 13.1 percent received D or F. However, when scores for the multiple-choice section of the AP Examination in Chemistry were projected to estimate total AP reported grades for the college students, it was found that 46.1 percent of the college students would have received a projected grade of 3 or higher on the AP scale, whereas 70.3 percent of the 1978 AP Chemistry candidates earned AP grades at or above 3.* The data, however, are to be read with caution as achievement may differ because many colleges do not give a final comprehensive examination covering the entire academic year, which is essentially what is asked of the AP student.

Comparative Test Data

The table below provides the measurement characteristics (score scale, mean, standard deviation, reliability, standard error of measurement, and percent completing 75 percent of test) of the three examinations listed.

*The substantial correlation of 0.95 between multiple-choice scores and reported AP grades suggests that equivalent scores on the multiple-choice section and the total AP Examination can be determined with a reasonable degree of reliability.

COMPARATIVE TEST DATA

	Score Scale	Mean[a]	Standard Deviation[a]	Reliability[a]	Standard Error of Measurement	% Completing 75% of Test
ATP Achievement Test in Chemistry	200–800	564	97	.93	25	98.6
AP Examination in Chemistry						
Multiple-choice (45% of score)	—	—	—	.92	—	99.8
Free response (55% of score)	—	—	—	.80–.90	—	—
Composite	1–5	3.1	1.2	.92–.95[b]	6.7–8.4[b]	—
CLEP Subject Examination in General Chemistry	20–80	50.0[c]	10.0[c]	.89	3.1	99.9

Note: The score on all multiple-choice sections of these tests is corrected for guessing by subtracting from the number of correct questions one-fourth of the number of questions marked wrong.

[a]Figures are for the most recent edition of the test.

[b]Based on composite raw scores for an edition of the test with a maximum composite score of 160

[c]Scale redefined for 1978 norming sample of 3,016 college students who completed a one-year course in general chemistry. Candidate data are not yet available.

Glossary

Mean: The average

Reliability: The consistency of the grade or score that candidates would receive if they were to repeat the examination (usually expressed as a correlation coefficient)

Scaled Score: A score to which a raw score is converted for reasons of convenience, comparability, and ease of interpretation

Standard Deviation: A measure of the spread (extent of variability) of a set of scores around their mean. The less the spread, the smaller the standard deviation

Standard Error of Measurement: An indication of the extent of the error inherent in an obtained score because of the imperfect reliability of a test. It indicates (in score units of the test) the range of discrepancy between the true score and the obtained score.

True Score: The score a student would earn if a test could measure ability perfectly

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Note: Requests for information about the use of a College Board program should be directed to your College Board Regional Office. Specific questions about any of the chemistry examinations may be addressed to the ETS consultant listed above, Educational Testing Service, Princeton, New Jersey 08541.

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